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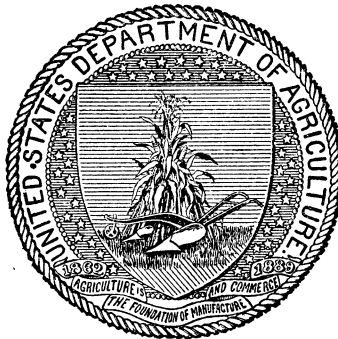
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# PIG MANAGEMENT.

BY

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*Animal Husbandman, Bureau of Animal Industry.*

[Revised March, 1908.]



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## LETTER OF TRANSMITTAL.

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U. S. DEPARTMENT OF AGRICULTURE,  
BUREAU OF ANIMAL INDUSTRY,  
*Washington, D. C., March 16, 1908.*

SIR: I have the honor to transmit herewith a revision of Farmers' Bulletin 205, entitled "Pig Management," by George M. Rommel, Animal Husbandman of this Bureau. The paper appeared in its original form in the Twentieth Annual Report of the Bureau of Animal Industry, and was subsequently published as a Farmers' Bulletin. Some corrections have been made in the subject-matter, and one illustration (fig. 16) has been added. That portion dealing with sanitation and the treatment and prevention of disease has been revised by Dr. John R. Mohler, chief of the Pathological Division, and the section on prevention and destruction of vermin has been revised by Mr. B. H. Ransom, chief of the Zoological Division.

There is a constant demand for information such as is contained in this article, and I recommend that publication be continued in the revised form.

Respectfully,

A. D. MELVIN,  
*Chief of Bureau.*

HON. JAMES WILSON,  
*Secretary of Agriculture.*

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# PIG MANAGEMENT.

## INTRODUCTORY.

The climate and soil which will best favor the production of any kind of live stock are those in which the same kind of stock is found wild. In his native state the hog frequents those localities where vegetation is abundant, if not luxuriant. The climate is usually one of only moderate severity. If extremes either of heat or cold are common, the environment provides shelter in the dense thickets in winter and shade and an abundance of water in summer. The hog is a heavy and promiscuous feeder, therefore in his domestic state he thrives best where pastures are most luxuriant and grain crops, nuts, or roots are most abundant. He is not a ranger, nor does he thrive on grass alone; he can not endure a great amount of travel at a time; exercise he must have, yet he must be able to find his feed with only a small amount of searching, and water should always be accessible. During hot weather he craves a pool of water to reduce his temperature, for he perspires little; and in winter he wants shelter from storms. Owing to these requirements there are few hogs in the semiarid States of the West, and in that section hog raising is generally coincident with irrigation and alfalfa growing.

The first place in hog raising in the United States is easily with the corn-growing sections, and here corn is the first grain thought of when the fattening of animals, especially hogs, is considered. It is, however, fallacious to argue that hog raising will not give profitable returns outside of the corn belt. The corn belt has wonderful advantages for economical pork production, but it also has its disadvantages. The cheapness and abundance of corn in the corn belt have often led farmers to use it as the exclusive grain feed. But breeding stock so fed does not thrive so well and is not so prolific as when given a varied ration, and when used for fattening an exclusive corn diet is not generally profitable. The work of the agricultural colleges and experiment stations during recent years has done much to show breeders and feeders the undesirability of this practice, and the increasing price of corn has forced farmers to economize in its use as much as possible.

Any locality that will grow clover of any species, or that is favorable to the production of alfalfa, peas, or beans, or where grains are readily grown—not only corn, but barley, wheat, oats, or rye—will be a favorable situation for the successful production of pork. If

it is also a locality where dairying is common, no better advantages are required; for, given leguminous pasture—clover, alfalfa, peas, beans, etc.—as a basis, with a grain feed that can be readily grown, and also dairy by-products, the very highest grade of pork can be produced at a minimum cost. Variety of feed alone is an item of immense importance in feeding. An animal tires of a constant ration of one kind, and is more easily put “off feed” at such times than when he is occasionally supplied with a change to keep his appetite keen. Not only has variety of feed an influence on appetite, but it results in a better quality of pork.

The few States comprising the corn belt are the source of supply for a great amount of the meat product, especially hams and bacon, that is consumed in other portions of the country. Yet the advantages of many of these corn-belt States are little, if at all, superior to those outside of that district. The South has an abundance of vegetation. Cowpeas, velvet beans, and peanuts are leguminous crops that are peculiar to that section. Corn grows readily in all parts of the South, and in the subtropical portions the experience of feeders with cassava seems to indicate that it has considerable value for pork production. In addition, there is generally an abundant water supply; the climate is mild, and there is a long period during which green feed is available; the expense of shelter and winter feeding is very greatly lessened. These conditions, giving a long period of pasture and outdoor life, enhance thrift, and with proper management insure great freedom from disease.

In the extreme West the alfalfa of the irrigated valleys and the clover of the coast districts give a splendid foundation for successful pork production. In most of these regions there is an abundance of small grain, particularly barley, that may often be fed economically, while in some localities corn is a successful crop.

Barley is of so much interest and importance in the production of prime pork that it demands more than a passing notice. This grain has not been relied upon to any great extent in America as the principal part of a hog-fattening ration, but the practice of Danish farmers and the results of experiments can very well be studied with profit by American feeders. The Danish bacon, which figures so prominently in the English markets, is produced mainly with barley and dairy by-products. At the Ontario Agricultural College, Day has found barley so valuable in the production of prime export bacon that it is now used as a standard with which other grains are compared. In his experiments to determine the nature and causes of “soft” pork, Shutt found that the best bacon produced was by a ration in which barley was at least one-third of the whole amount. Farmers in those parts of the country where barley is a prominent crop can well devote

attention to their opportunities for pork production; besides, in addition to this grain, some of the leguminous crops can often be grown for pasture, thus furnishing materials for a well-balanced ration.

The purpose of these remarks is not to minimize the value of corn in meat production of any kind. Corn is, perhaps, with a favorable climate and soil, the most economical grain that is at the command of the stock raiser and feeder in those sections of the United States where it can be grown successfully. It is nutritious and highly palatable. Without its use it is difficult to imagine how the animal products of the United States could have attained their present position in the world's commerce; and so long as meat products are a factor of American agriculture corn will probably be a leading element in meat production in this country, and the corn belt will naturally continue to be more or less the center of feeding operations. On the other hand, the condition is ever present that farmers in localities where corn is a limited product have their own wants to supply. If, in addition to their own needs, the farmers of these localities can supply a share of the export demand, great strides will have been taken in their agricultural development, for "live-stock husbandry is the foundation of successful agriculture." A market for the surplus is, of course, essential, but where a supply is available the market will probably be forthcoming.

## **HOUSES, INCLOSURES, FENCES, ETC.**

### **THE HOUSE AND ITS LOCATION.**

Hogs are easily affected by extremes of heat and cold, and the character of their shelter will therefore depend on the locality. If the locality is one of severe winters, warm quarters are a necessity. In erecting a piggery in northern latitudes four things should be especially considered—(1) light, (2) ventilation, (3) warmth, and (4) cleanliness. Under cleanliness, ease of cleaning and dryness must be regarded. A well-drained location should be chosen; one that will give the hogs a good climb to reach it will provide needed exercise. The house should be on a north and south line, so that both sides may receive direct sunlight during a part of the day. Mr. John Cownie,<sup>a</sup> of Iowa, recommends a house with a wide driveway, with pens 6 or 8 feet square on either side opening into the driveway, and each pen provided with a window for light and ventilation. Mr. L. N. Bonham,<sup>b</sup> of Ohio, recommends a house with a row of sleeping pens on either side of a cement-floored alley, opening into feed pens floored with cement. The sleeping pens are floored with boards laid in gravel or cinders. Paving brick costs about twice as much as cement.

<sup>a</sup> Thirteenth Biennial Report of Kansas State Board of Agriculture, p. 605.

<sup>b</sup> Breeder's Gazette, February 18, 1903.



Figure 1 shows the end view of a house arranged on plans similar to these. Figure 2 shows the floor plan of the same house. The pens are 8 feet square. Each pen has two doors and a window. One door opens into the driveway and the other into the feed pen. If it is desired to protect the hogs from visitors, it may be found well to dispense with the door into the driveway, in which case the latter need not be wider than necessary to permit driving through with a wagon. The windows are hinged and open downward. Ventilators are provided in the roof. The feed rooms may be located in either end of the house. They should be at least as large as the pens, and may be on both sides of the driveway or extend entirely across the end of the house. In the latter case the driveway should be dispensed with or made wide enough to enable a wagon to turn around in it.

If no other means of ventilation than the windows is provided they should be so arranged that entering air currents will be directed

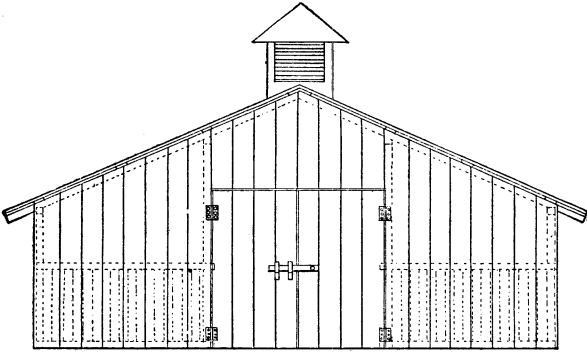


FIG. 1.—Hog house for northern latitudes, end elevation.

upward when the windows are opened and direct drafts on the hogs avoided. The size of the house and its equipment will depend upon the size of the herd and the resources of the owners. Not more than fifty breeding hogs should be confined in one house; sanitary considerations make a smaller number much safer. Out of doors the number of hogs in one inclosure may be increased considerably above fifty without danger.

The arrangement of the pens will depend largely on the climate and the convenience. A very common plan is to have only the sleeping pens under cover, building feeding pens of the same size just outside the hog house and adjoining it. If these pens are floored substantially with concrete, they will last well. If the floor is properly laid, fitting closely to the posts and baseboards, there will be little danger of the hogs doing damage to the walls of the house by rooting, and rats will be prevented from burrowing under the walls.

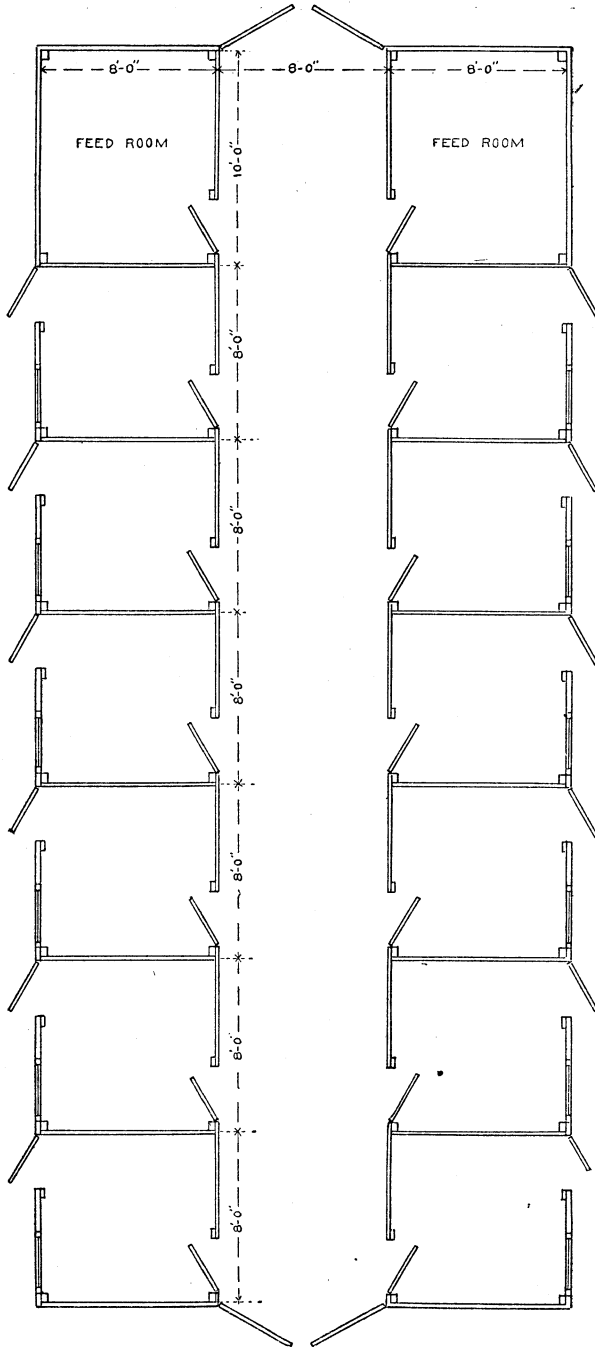


FIG. 2.—Hog house for northern latitudes, floor plan.  
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Figure 3 shows this arrangement of pens for the house in figure 1.

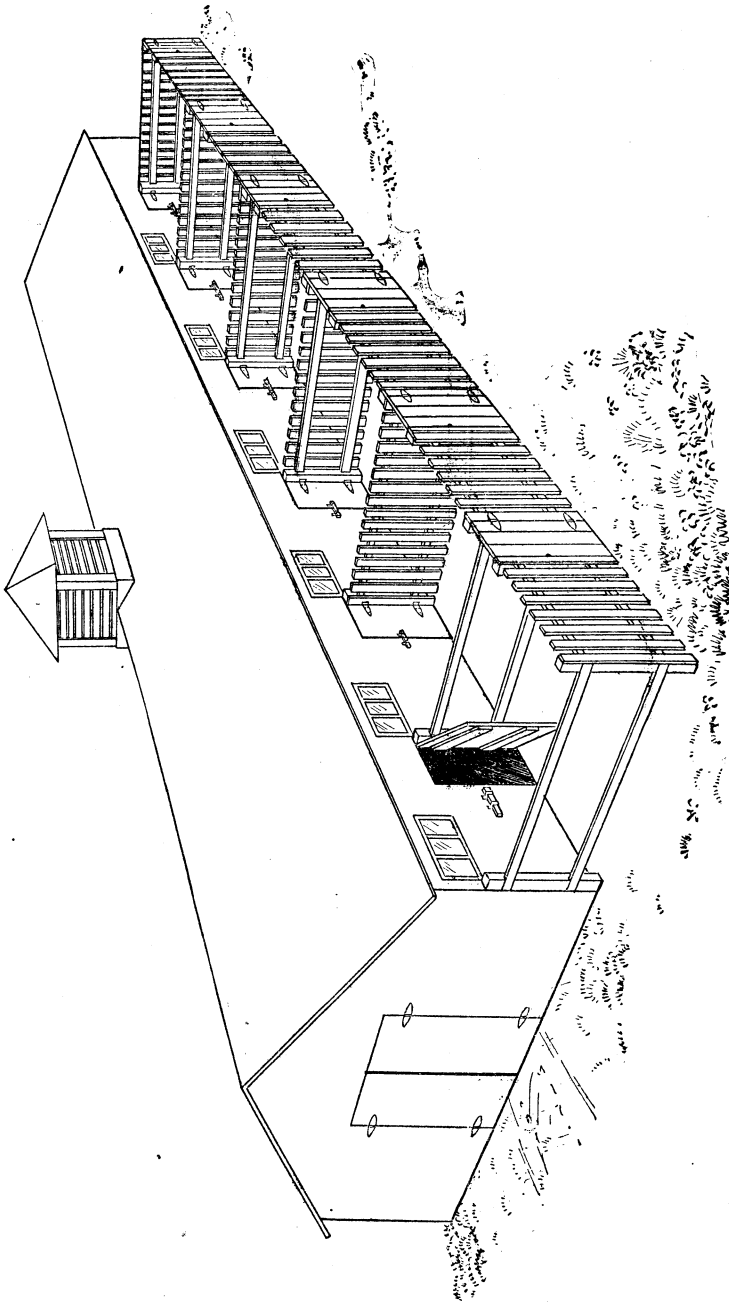


FIG. 3. Hog house for northern latitudes, side elevation; showing arrangement of outside feeding pens.

The advantage of this plan is that the sleeping and feeding pens are separate. The main part of the manure will therefore be left in the

outside pens and can easily be removed. If separate feeding of the pigs is not necessary, the outside feeding pen need have no partitions. This arrangement will doubtless be more convenient for those who breed only for the market. The feeding pen connects with the pasture.

Where it is desirable to have both sleeping and feeding pens under cover, the pens in the house can be enlarged. A convenient plan for such a pen is used by the Michigan Agricultural College. The pens are 8 by 16 feet. A false wooden floor is built, of strong materials—usually 2 by 4 inch stuff—in two sections of equal size. This false floor is made small enough to fit conveniently into the pen, and rests on cleats in the bottom of the pen. As a rule only one section of the floor is used at a time, this part of the pen being kept bedded and used as a sleeping pen and the remaining part being used as the feeding floor. (Fig. 4.)

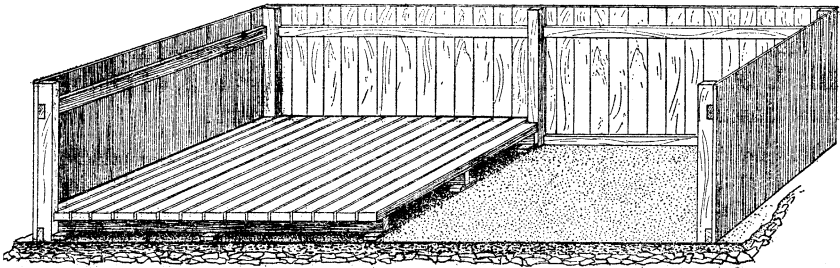


FIG. 4.—Pen arranged with sectional floor.

Under any circumstances the house should be well constructed and warm. If boarded up inside with good matched siding, such a house will be comfortable in zero weather, and sows may farrow there with safety. Concrete or brick floors are expensive, but if the initial expense can be incurred and the floors are well laid they will pay good interest in the saving of manure and the dryness of the house. Animals should not be compelled to sleep directly on such floors, for rheumatism and colds are very likely to result. The best floor for a sleeping or farrowing pen is one of wood on concrete, the wood being 2 by 4 inch timbers, laid from one-fourth to three-eighths inch apart to allow drainage. If not constructed in this way concrete and brick floors should be kept well littered. A clay or ordinary earth floor is excellent, and by some preferred to any other. It is the warmest floor, but not so easily kept clean as one of brick or concrete. If a house is constructed with earth floors care must be taken that the floors are well drained, both underground and on the surface.

The greatest necessity for a good house is at farrowing time, for it is then that more pigs die than at any other. If the sow farrows in a

damp or cold place or in drafts, serious results to the sow or the pigs or to both will follow. At this time the sow is seriously weakened, and she is very susceptible to exposure, while newly born pigs are easily stunted or killed by chilling. Rheumatic ailments are common with pigs, and are often caused by damp, chilly sleeping places.

#### PORTABLE HOUSES.

The portable house is coming into very general favor, especially in disease-infected districts. It is of various forms, and should be large enough for five or six grown hogs, with enough height to allow a man to stand erect; 6 by 6 feet, 6 by 8 feet, or 8 by 8 feet are good sizes. Such houses should be strongly constructed of good lumber, with perfectly tight siding and roof. They may be made with or without floors. If lined inside with the same materials as outside, such a house will be warm enough for a sow and pigs in zero weather; and on extremely cold nights a lantern hung in the house will provide warmth enough.

The plan for a portable house used by two successful breeders—Mr. A. J. Lovejoy, of Illinois, and Mr. L. N. Bonham, of Ohio—have been described in the agricultural press, as follows:

The Lovejoy pens or portable houses are each situated in the middle of an acre lot and on either side of a driveway, the divisions being made by the use of wire fencing. The houses are 8 feet square. Four 16-inch boards make the floor, and the roof and sides are made of matched flooring lined with building paper, and that covered on the inside with common lumber. The houses are set to front south. There is a door in both north and south ends, and a window in the south end, the latter being hinged at the top with a rope and pulley attached, so that it can be swung up out of the way when it is open. In cold weather and early spring the north door is closed, and, if necessary, the south openings are also closed, fresh air being secured through the ventilator in the roof by carrying the ridge a trifle higher than the sides that comprise the roof. [Fig. 5.]

In hot weather the houses are converted into summer resorts by leaving both doors and window open. Each house is nicely painted with two coats and trimmed in white, and costs, complete, about \$10. They are set up on blocks in the summer to keep the floors dry, and in the winter time they are dropped to the ground and banked to keep the wind out from under the floor.

The primary object of the Bonham pig house is to secure shelter, warmth, sunshine and pure air at reasonable cost, and the secondary object is to have it as handy for feeding and handling the sows and pigs as possible.

For some sows the main roof may be shortened 18 inches. This will give a pitch to the front, and a sash 6 by 1½ feet in front to let in the sunlight and keep out the rain and cold may be provided. This adds a little to the cost, but makes an ideal shelter for spring litters, when sunshine is never in excess and of inestimable value. In very cold weather we add a swinging door, but a gunny sack hung at the top of the door will do. If the weather is below zero and windy, a lighted lantern hung to the roof inside until the pigs are dry and have had their first meal of the sow's milk will keep them comfortable in

the coldest weather. The warmth of the sow is sufficient in other weather to keep the pigs comfortable in such a pen.

This house is 5 by 6 feet. Four scantlings 2 by 2 inches by 12 feet and two scantlings 2 by 4 inches by 12 feet will make the frame and roof supports. The

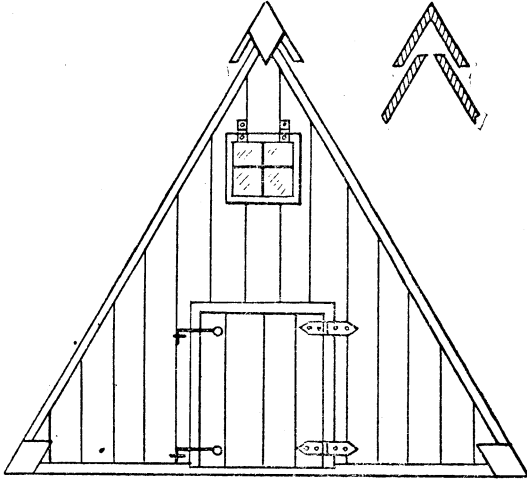


FIG. 5.—Lovejoy portable hog house, end elevation.

bottom rail is 2 by 4 inches, the others 2 by 2 inches. The three pieces for the roof are cut 6 feet by 6 inches to give a 3-inch projection of the roof beyond the sides.

[Figure 6 shows the house set up and the drop window partly down. Fig-

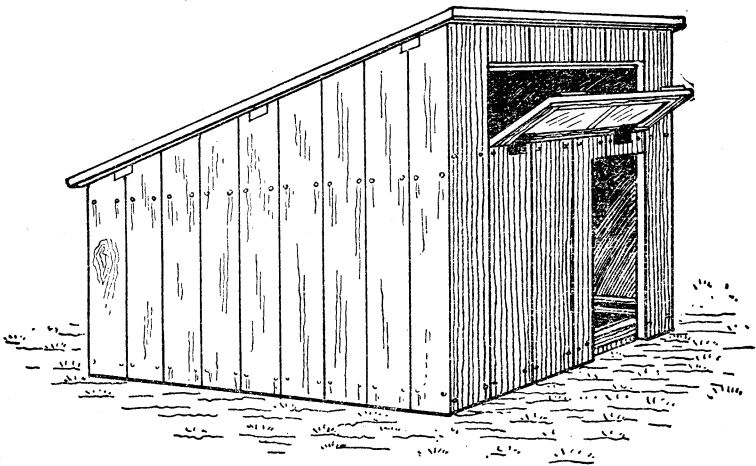


FIG. 6.—Bonham portable hog house.

ure 7 shows the top off.] The construction is readily seen. After the house is ready to set together have the floor made just large enough to let the sides of the house set outside the floor. The cost of this house is about \$5. It pays

to paint the roof every three years, but the sides will last without paint as long as the roof is well painted. Taken down each fall and spring and whitewashed and set up against a fence or in a shed until needed, it will give long service.<sup>a</sup>

A leading advantage of a portable house over the piggery system of several pens and a large number of hogs under one roof is its ease of management in times of epidemic. Only a few animals can be kept in one pen, and the isolation of the diseased animals when an outbreak begins is thus rendered comparatively easy. When cholera breaks out in a crowded piggery every animal in the building is exposed, and the farmer, though he may isolate the unaffected animals at once, does not know how soon the second outbreak will occur; he has no check whatever on the epidemic. But with portable hog houses each house is itself a cholera check, and only infection directly from diseased animals can spread the disease.

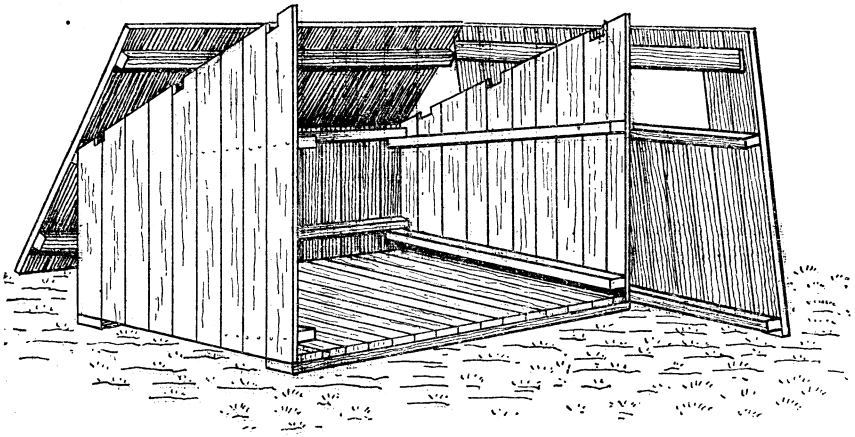


FIG. 7.—Bonham portable hog house, showing plan of construction.

#### HOUSING IN MILD CLIMATES.

In the South and in much of the country west of the main chain of the Rocky Mountains the winters are sufficiently mild to obviate the necessity of constructing buildings of much warmth. Not only are the winters mild, but they are comparatively short, and green feed is available much longer than in other parts of the country. In such localities a shed will often suffice, but it should be well constructed, in order to provide protection from storms and damp, chilly weather. The location should be high and well drained, affording clean, dry sleeping places; the shed should open to the south. The expense of such a building is well warranted in view of the added comfort to the stock and increased number of pigs raised. Under all circumstances, regardless of climate, whether a man is breeding pure-

<sup>a</sup> Breeder's Gazette, January 6, 1904.

bred stock or grades, hogs should have sleeping places that are dry and warm and feeding places that are clean.

Figure 8 shows the elevation of the house used by the Maryland

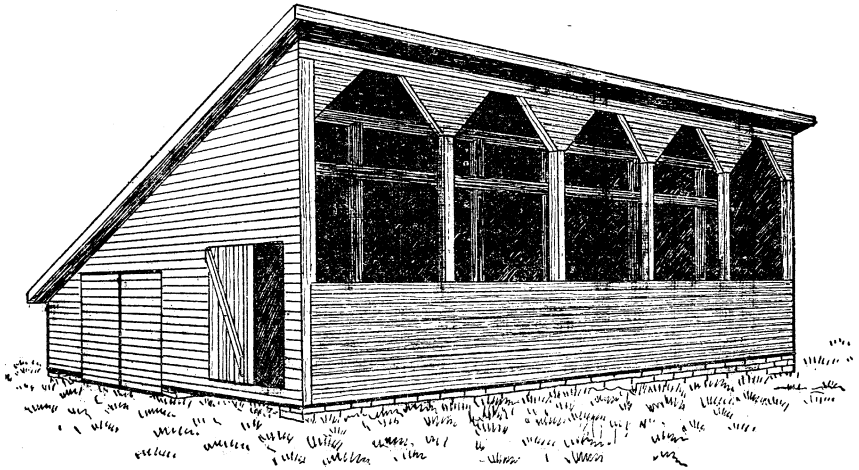


FIG. 8.—Hog house for southern latitudes.

Agricultural College, and figures 9, 10, and 11 show the floor plan, the end elevation, and the arrangement of the troughs and feed bins.<sup>a</sup>

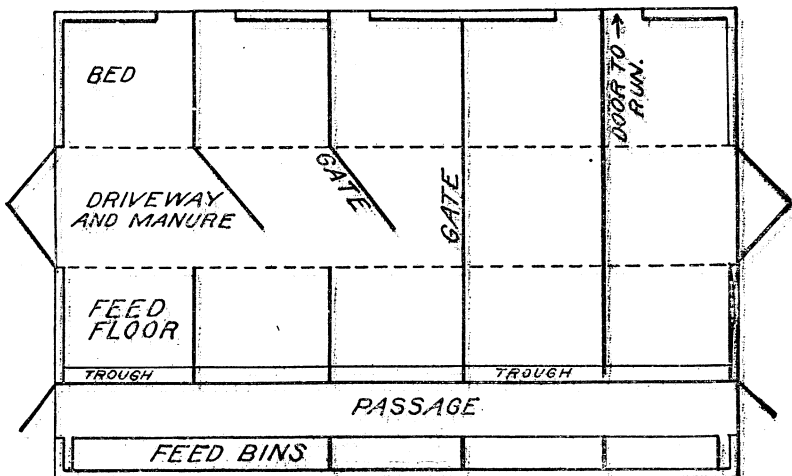


FIG. 9.—Hog house for southern latitudes, floor plan.

The front faces south, and is open and raised sufficiently to allow the sun's rays to penetrate to the extreme end of each pen. Sunlight and ventilation are thus provided by the same means. The feed bins are

<sup>a</sup> Bulletin 63, Maryland Experiment Station.



placed against the front of the house, a passageway intervening between this and the pens. The pens have swinging fronts, so arranged that the feed can be placed in the troughs and evenly distributed be-

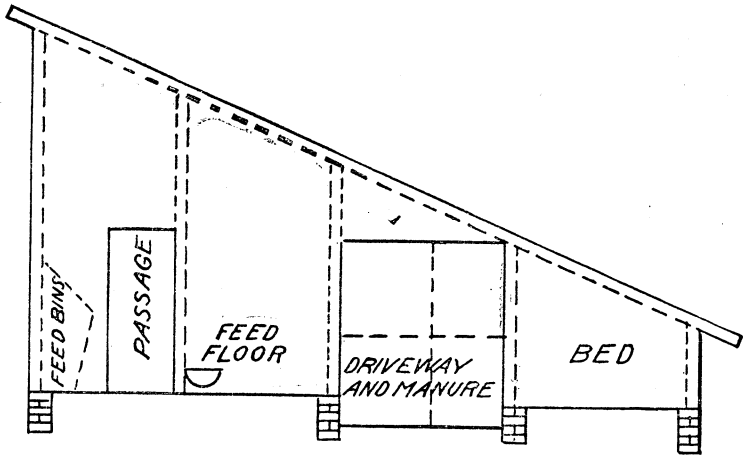


FIG. 10.—Hog house for southern latitudes, end elevation.

fore the pigs get to it. Back of the feeding floor is a depressed driveway, which is kept well bedded, and serves also as a manure pit, and at the rear of the house are the sleeping pens, from which doors

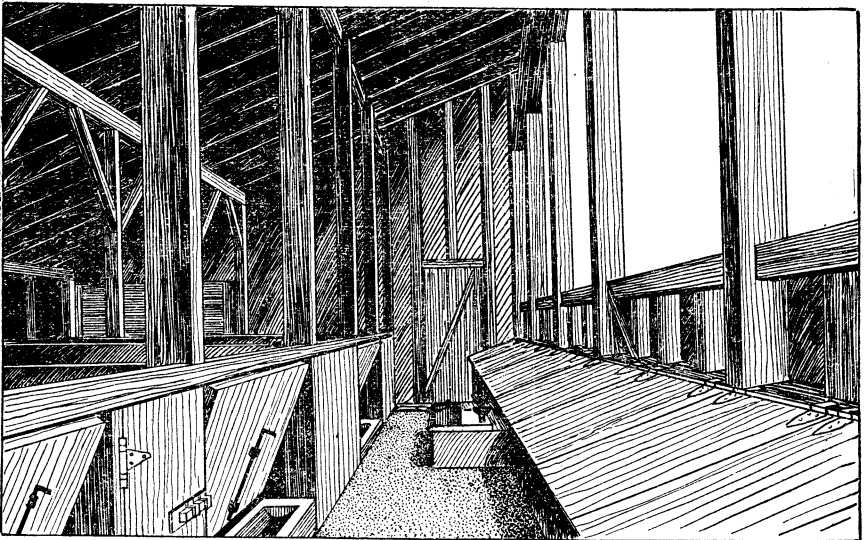


FIG. 11.—Hog house for southern latitudes, showing arrangement of troughs and pens.

open into the yard. The feeding floor and sleeping pens slope slightly toward the driveway. The gates of the sleeping pens extend entirely across the front and are the same width as the driveway.

These gates are opened across the driveway except when cleaning; at this time the hogs are driven into the sleeping pens or on into the yards, the gates of the pens closed on them, and the cleaning proceeds with no interruption from them. The gates and partitions between the pens are constructed in lattice fashion, which allows free circulation of air.

#### TROUGHS.

Well-made troughs are a necessity in pig feeding. The time-honored V-shaped trough (fig. 12) is very common and is doubtless familiar to all who handle hogs.

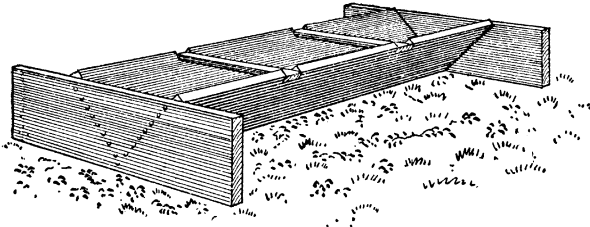


FIG. 12.—V-shaped trough.

Theodore Louis advises the use of a low, wide, shallow trough (fig. 13). Troughs should not be so long that they can not be handled by one man, and they should be so strong that they will not readily be broken to pieces by the pigs.

A very convenient arrangement of the feeding troughs is shown in the drawings of the Maryland Agricultural College hog house. The troughs extend across the front of the pen and are built solidly, so

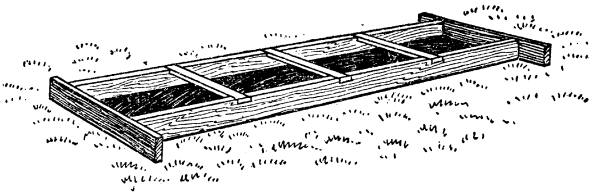


FIG. 13.—Shallow trough.

that they will not be displaced. The front of the pen is hung on hinges, and attached to it is a strong iron rod which fits into holes in the edges of the trough and holds the pen front firmly. When filling the troughs the pen front is swung back and the rod inserted in the inside edge of the trough. The pigs can not then get to the feed until the front is lowered. The plan permits feeding without being disturbed by the eagerness of the animals, and the feed is evenly distributed. (See figs. 11, 14, and 15.)

Wooden troughs are objectionable in some respects. They are not

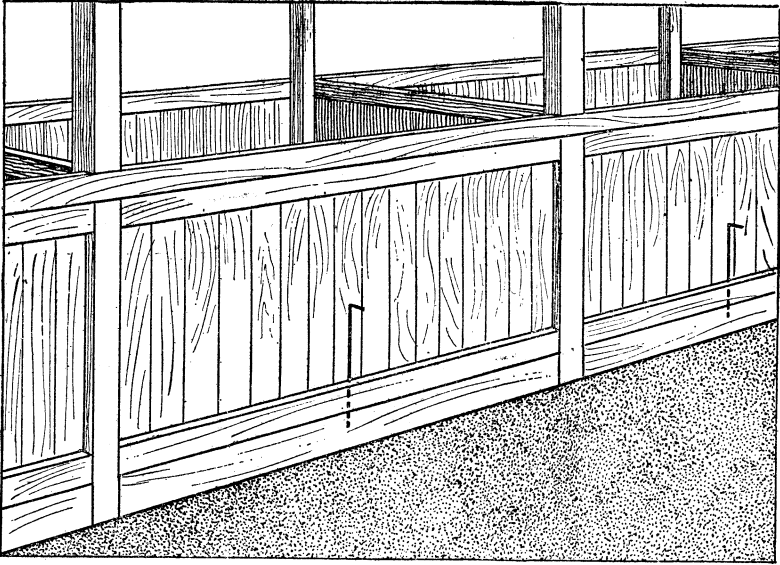


FIG. 14.—Pen with swinging front, closed.

very easily kept clean and are not durable. Iron troughs are used to a considerable extent and have much to commend them. They are

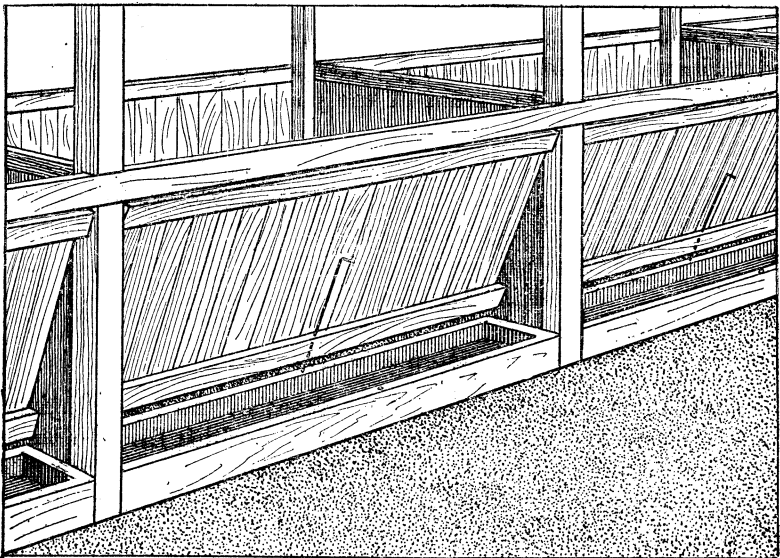


FIG. 15.—Pen with swinging front, open to allow filling of troughs.

more sanitary than wooden ones, and with proper care will last indefinitely.

Concrete troughs can be readily made and are especially desirable where the floors of the house are concrete. Like iron troughs, when well made they are very durable.

Figure 16 shows the interior arrangement of the hog house at the Illinois Experiment Station. The sides of the pens are constructed of hollow iron tubing and woven wire, which makes them very light but exceedingly strong. The sanitary character of the construction is apparent. Floors and troughs are made of concrete, and the pens have swinging fronts, which operate in a similar manner to those shown in Figures 14 and 15.

### PENS AND PASTURES.

The question of pens and pastures, both as to size and location, must be determined by each one for himself. Local conditions, ex-

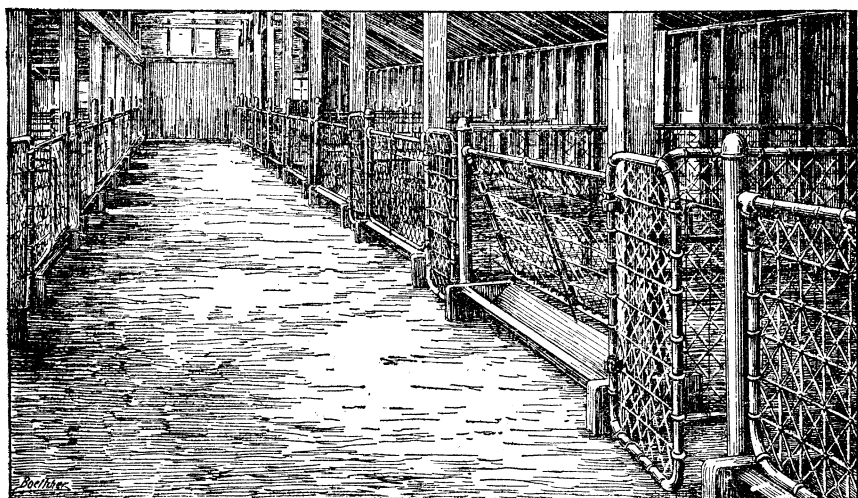


FIG. 16.—Interior arrangement of hog house at the Illinois Experiment Station.

pense, and convenience must be considered. A good rule to follow is to favor large inclosures rather than small ones. A number of pens and several pastures will be found a convenience and are particularly valuable when disease makes its appearance, as hogs affected may then be isolated at once. A quarantine pen with an absolutely tight fence should be arranged on every farm where hogs are kept. Here all newly purchased hogs should be confined after arriving at the farm until all danger of infection is past.

It will generally be a satisfactory practice to keep hogs away from other stock except when following fattening steers. Pregnant brood sows should never be allowed to run in the same yards or pastures with cattle, horses, or mules. Many good sows have been ruined by the playfulness or viciousness of the larger farm animals.

The pen and yard for the boar should be separate from the rest of the herd and out of sight of it. The pen should be so strong that the boar can not tear it down or go through it, and a tightly fenced pasture of one-half to 1 acre in area should adjoin.

A sow about to farrow, if she is to farrow in the piggery, can have the run of the alley for exercise. If she has a house to herself, a small yard should adjoin.

#### FENCING.

No man should attempt to raise hogs without adequate fencing of yards and pastures. An animal of any kind, but especially a hog, can make himself an intolerable nuisance if not confined within proper bounds. For pastures woven wire is the best fencing material, all things considered. Such a fence may be purchased ready-made or may be made on the farm by machines, of which there are several good kinds on the market. From motives of economy it may be desirable to run a fence of woven wire around a field to a height of 30 to 36 inches, and above this to stretch two or three strands of ordinary barb wire. This will make a hog-tight fence, and if horses are necessarily placed in the field the fence will be much safer than the ordinary one made entirely of barb wire. Midway between the posts the lower strand in the fence should be securely stapled to a small post or stake; this will prevent hogs from working their way under the fence. A further precaution against this may be secured by plowing a furrow against the lower strand, or, better still, by digging a trench 5 or 6 inches deep along the fence line and nailing 2 by 12 inch planks or cedar or locust poles to the posts and fastening the lower strand to these. In building any kind of wire fence, ground wires may be put down to moisture at frequent intervals to give stock protection from lightning.

A board fence makes, perhaps, the most secure inclosure for hogs, but its expense precludes its use generally except for yards and pens.

Barb wire is very poor material for a hog fence. It can hardly be made close enough or strong enough to prevent a shoat from crawling through. In this respect it is only a little better than a hedge, which is expensive and unsatisfactory when used to confine stock. Gates must, of course, be carefully made, hung, and fastened.

#### PORTABLE FENCES AND HURDLES.

When hogs are run on annual forage crops, such as rape, rye, wheat, oats, or sorghum, temporary fences are almost absolutely necessary. They should be light, strong, and portable. A plan for such a fence is seen in figure 17. It was designed by Mr. J. E. Wing, of Ohio. Concerning this fence, Mr. Wing says:<sup>a</sup>

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<sup>a</sup> Breeder's Gazette, February 3, 1904.

Perhaps the combination of wire and wood will serve best; it is light, cheap, and, if good wood be used, is durable. Get something that will not warp or twist. Hemlock will serve, and 1 by 6 inch stuff is heavy enough, though if it is to have much hard use, 2 by 6 inch will be better. The illustration [fig. 17] shows clearly how it is put together, with long nails clinching or bolts. Buy

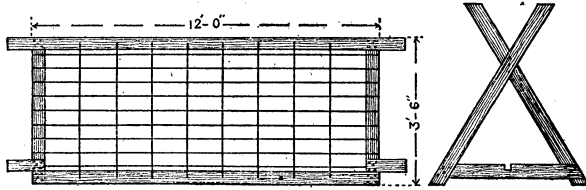


FIG. 17.—Wing's portable hog fence.

wire fencing, cut it into suitable lengths, leaving the ends long enough to pass clear around the end pieces and tie. Tie the wire also to the horizontal pieces at intervals.

Except for special purposes it is better to buy woven-wire hog fencing, stretch it about the land to be pastured off, support it by stakes, and when through with it roll it up again and take it away.

Figure 18 shows a diagram of a hurdle which is very useful in catching hogs or driving them for short distances. This hurdle is

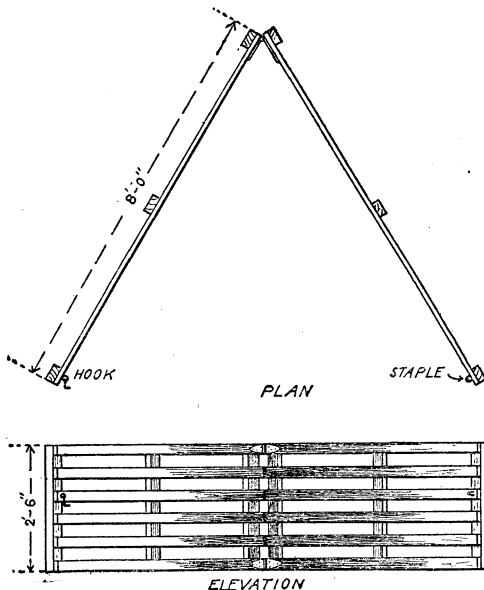


FIG. 18.—Hurdle.

made of 2½-inch stuff, 8 feet long, with the strips 3 inches apart, making the sections 30 inches high. Two sections of this size are hinged together. The hurdle is arranged with a hook and staple. A second hurdle may be made, with hook and staple to correspond with this, and when hooked up the two make an inclosure 8 feet square, which is very convenient for confining hogs temporarily.

## THE FOUNDATION HERD.

### SELECTING THE SOWS.

The first selection of breeding stock is of prime importance. The effects of mismating are always difficult to breed out of a herd, and the effect on a beginner is such that a mistake may completely discourage him. It is good economy to make haste slowly at this time. The start should be made with a few animals; five sows should make a large enough herd for the first year. They should be good individuals, and it will even be much better to buy one high-class sow than five poor ones. This would be real economy, and the development of the herd will prove its value. It will be well if a beginner can obtain the assistance of an old and successful breeder in making a start.

The expression "the male is half the herd" is repeatedly quoted. So far as our knowledge of heredity has developed, other conditions being equal, there is uniform prepotency in both sexes; the influence of the two parents on the offspring is theoretically equal. Therefore, if the boar is half the herd, the sows certainly make up the other half, and their selection is a highly important matter. They may be purchased, already bred, some time before the boar, and quite an item of expense will thus be saved. Then by the time the sows have been watched and studied for a season and have each raised a litter of pigs, the owner will be much better prepared to select a suitable male, and he can then get one to use on both dams and offspring.

The sows selected should be nearly the same age, which should be about twelve months, and all should be safe in pig, preferably to the same boar. Their individual characteristics should, perhaps, be first looked to. While hogs do not show the strong differences of sex that we look for in a cow or a mare, sex characteristics always constitute a marked feature of a good brood sow. The smoother forehead and lighter, finer neck are points of distinction from the signs of masculinity in a boar. The forehead should be broad between the eyes, the throat clean and trim, the neck moderately thin, and the shoulders smooth and deep; the back should be fairly wide and straight, and ample room for the vital organs should be provided by a good width and depth of chest, well-sprung ribs, and straight, deep sides—a deep, capacious body from end to end. Depth of chest and abdomen are specially important in a brood sow. Pinched chests and waists must be avoided. It is generally advised that sows with much length of body should be selected for breeding purposes, length of body being regarded by some as an indication of fecundity. It will certainly do no harm to select sows that are especially long, but care should be taken that quality goes with the increase in length. The loose-jointed, long-coupled, slow-maturing, and slow-fattening type should not be

allowed to get a foothold in the herd. The influence of length of body on a sow's fecundity is by no means positively known. Many very short-bodied sows have proved to be wonderfully prolific breeders. The surest means by which to select prolific sows is to keep an accurate record of the herd and cull out all sows that do not yield a certain percentage of pigs annually. Each sow should have at least twelve well-developed teats, thus providing for the proper nourishment of large litters.

The important qualifications of the market hog should be looked for, namely, smoothly covered shoulders, a wide, straight, deeply fleshed back, well-sprung ribs, straight, deep sides, broad rumps, and deep, well-rounded hams. A broad, well-developed pelvic cavity will generally insure easy parturition in a sow. The body should stand on moderately short, straight legs, with a moderate amount of bone. All hogs, particularly breeding animals, should stand well up on the toes. There is a tendency, more marked in some breeds than in others, for the pasterns to break down, so that the animal walks on the pastern bone instead of on the toes. This is particularly the case with the hind pasterns and is oftener noticed in boars than in sows. It is a weakness that seriously impairs the usefulness of the animal.

Brood sows should, of course, show quality, but this should not become overrefined and delicate. Extremes of refinement usually lead to delicacy of constitution and often accompany sterility.

As a last but very important point, these first sows should be uniform in type. Uniformity of type goes far beneath the surface. It includes every part of the internal organization. The reproductive system, the digestive system, the circulatory system, and even the nervous system influence uniformity. The breeder may often be disappointed in his results from sows that he thought were of a uniform type. His pigs are a heterogeneous lot, unpleasing to the eye, unsatisfactory in the feed lot, and profitless to the pocket. In such a case a lack of uniformity in the powers of heredity may no doubt be assigned as the cause of these unfortunate results. It must be borne in mind that it is comparatively easy to select sows that are uniform in quality, constitution, and conformation. This may be done by any skillful judge of hogs. But our only basis for the selection of animals uniform in reproductive powers and heredity of type is the breeding record of their sires and dams and the standard of the herds from which they come. For this reason it is readily apparent why it is an advantage for the beginner to select his sows from one well-established herd. Whether the sows will be uniform in breeding powers can only be determined definitely by testing them in the herd, but to select them from the same herd or from herds of similar breeding will be a reasonable guaranty of good results. When a sow has



shown herself to be a prolific breeder she should be retained as long as her reproductive powers are maintained.

Uniformity in a herd is the surest index to the worth of the stock and the skill of the breeder, and its advantages are obvious. A uniform lot of pigs will feed better, look better when fattened, and command a higher price on the market than a mixed lot. With a bunch of sows closely conforming to the same standard, whose reproductive powers are similar, uniform pigs may be expected.

The importance of the male in the herd should not be asserted at the expense of the females, yet the importance of a male of marked excellence must not be minimized. The boar represents 50 per cent of the reproductive power of the herd concentrated in one animal; the sows represent an equal amount of reproductive force, divided up among ten or twenty or fifty individuals. If, then, these females do not conform strictly to the same type, they are merely convenient machines for the birth and rearing of young—not what they might be, an influential force in furthering the plans of the breeder and raising the standard of the herd. It is not proposed to discuss at length in these pages the operation of the forces of prepotency as varying factors in breeding operations. The relative influence of one parent over another, the swamping of a weakly organized female influence by a strongly prepotent male factor, or vice versa, are interesting and important, but belong to the special study of heredity.

#### SELECTING THE BOAR.

If there is a tendency at times to exalt unduly the influence of the boar and neglect that of the sows, the beginner should not permit himself to reverse things and entirely neglect the boar. A breeder can not afford to neglect the animals of either sex. The male has, perhaps, the greater influence on the herd, for the simple reason that every pig in the herd is sired by him, whereas they have not all the same dam. To achieve the best results a breeder should never allow the standard of his sows to be lowered, and should always couple them with a boar of a little better grade. A superior boar may be used on a herd of inferior sows with good results, but the use of an inferior boar on sows of high quality will have a disastrous outcome. The one method raises the standard of the herd; the other inevitably lowers it.

A boar with the male characteristics strongly developed should be selected, preferably as a yearling, or else as a pig that has been purchased at the same time as the sows and allowed to come to maturity before being used. He should have a strongly masculine head and a well-crested neck. His shoulders should be developed according to age; but strong shoulder development in pigs under a year or eighteen

months is objectionable. The same indications of a good pork-producing carcass that the sows required should be seen in the boar—a broad, straight, deeply fleshed back, much depth and length of side, and well-developed hind quarters. The boar should be selected to correct any defects that may be common to the sows; for example, if the sows are rather coarse in bone and loosely built, the boar should have high quality—fine bone, skin, and hair. If the sows tend toward over-refinement and delicacy, the boar should be rather “rangy” and strong-boned. There is a common belief that the male parent influences principally the extremities and general appearance of the offspring, while the vital organs (the heart, lungs, and viscera), conformation, and size resemble those of the female parent. This theory is strongly questioned by some modern authorities on heredity; but so long as our knowledge of the subject is so limited, and this particular phase is in dispute, it can do no harm to select breeding animals according to the old ideas. The visible organs of the reproductive system should be well developed and clearly defined. A boar should not be bought with small, indefinitely placed testicles. Avoid particularly a boar with only one testicle visible.

The boar should stand up on his toes. There should not be the slightest indication of weakness in the pasterns of a young one; in a mature boar (2 or 3 years of age) that has seen hard service it may be expected that he will be a little down on his pasterns, but a 6 or 8 months old pig that does not carry himself on upright pasterns is not a safe animal to select for a herd boar; the hind pastern will be in much danger of breaking down with a little age and service. Look carefully to the set of the hind legs. The hock should be carefully set and straight. A crooked hock is as great a drawback as a weak pastern.

### **FEED AND MANAGEMENT.**

The details of selection, feed, and management of live stock are intricately interwoven and interdependent. A man may be an excellent judge of stock, able to select those animals for his herd whose use will give the best results in breeding; but if his system of feeding and management is not such that the animals will thrive and yield a good increase, good selection is rendered ineffective. On the other hand, the herd may be carefully fed and skillfully managed, the feed may be the best and properly combined, the shelter warm and dry, and the water supply pure; but if the herd is poorly selected the owner is practically throwing away the feed he gives them.

### **THE SOWS.**

Hogs require attention, regardless of condition, age, or sex, but the management of the brood sows is the surest test of the breeder's skill.

If sows are carelessly fed during pregnancy, trouble of some kind is sure to ensue at farrowing; if overfed after farrowing, losses may occur among the pigs from scours and thumps. At no time is the development of the pigs so easily influenced as while they are dependent on the sow's milk—the first month of life. Excepting the ravages of epidemics, perhaps the greatest death losses in the herd occur during this time, including farrowing. The accidents during farrowing, an attack of scours due to the milk of the dam, or a chill while following the sow in pasture on a wet day may stop growth temporarily, leaving a permanently stunted pig, or may result fatally. On the other hand, the results of good management during pregnancy are as marked as the unfortunate consequences of careless methods.

**Management during pregnancy.**—It is assumed that sows that are bred are purchased as the foundation stock. If these sows are not all from the same herd they should not be placed together until they are all known to be free from vermin and contagious disease. They must be washed or dipped and quarantined from each other at least thirty days. If they come from the same herd no quarantine will be necessary.

It is always well for a purchaser to ascertain from the seller the details of management and feeding to which the animals were accustomed before changing owners. This system of feeding should be conformed to, or, if this is not possible, the old ration should be gradually replaced by the more convenient one, the time of transition being from ten days to two weeks. For the first few days newcomers should be fed lightly.

During pregnancy two facts must be borne in mind. The first is that the sow is doing double duty. Not only is she keeping up her own bodily functions, but the development of the fetal litter is a constantly increasing drain on her system. Although feeding at this time will not need to be so heavy as after the pigs are farrowed, it should be liberal. The sow's condition should be "good"—neither too fat nor too lean. An error which would allow the sow to become fat would perhaps be least productive of serious consequences. It is hardly too much to say that the mistakes in feeding breeding animals are more frequently those that keep such stock in a thin, half-starved condition, under the idea that the reproductive organs are so peculiarly liable to become transformed into masses of fat that the least appearance of fat on the animal's back and ribs will be the first step in bringing about such unfortunate circumstances. The use of the reproductive organs in either sex creates demands of an unusual nature on the animal organism, and these demands must be met in the same manner as those of a different character—such as growth, work, etc.—and that is by providing liberal supplies of the proper

kinds of feed. It is beyond reason that a sow can give birth to a strong litter of pigs after having gone through a four months' fast. The importance of ample feeding of pregnant females, in the case of sheep, has been shown by Mumford<sup>a</sup> in Missouri. He found that during the first six to nine weeks of life those lambs having the heaviest birth weight made the greatest gains. The records of the gains of the lambs after weaning were not tabulated. As the development of the fetus is intimately associated with the nutrition of the dam, it is urged that "we can profitably pay more attention to the development of the unborn lamb." Whether a similar fact may be true in the case of hogs is yet to be shown. It may not be unwise to assume that it may be so. Bad results undoubtedly may be brought about by overfeeding, especially as sows are naturally indolent and loath to exercise, but a counteracting influence will be found in ample exercise that may be provided by a large pasture or even by driving slowly a mile or two each day. The necessity of exercise must not under any circumstances be overlooked.

It must be remembered, in the second place, that the main demands upon the sow are those for the building of new tissue. Hence the kind of feed is important. The amount of nitrogenous, or protein-bearing, feeds in the ration at this time should be increased. These are bran, pease, beans, oats, and barley, and, to a moderate extent, wheat. The forage plants that are especially suitable to pregnant brood sows are the clovers and their relatives—alfalfa, pease, beans, vetches, etc. The ordinary pasture grasses are also of much value. Feed should be given in such form that the system of the sow will be at its best. All breeders lay special emphasis on the condition of the bowels during pregnancy, and particularly at farrowing, the special danger to be avoided being constipation. To this end the greater part, if not all, of the grain ration is given as slop, and toward the close of the period of gestation oil meal or a small amount of flaxseed meal is introduced into the ration.

Corn should not be fed in large amounts to breeding stock. If possible, it should not be fed at all to any but fattening animals. In the corn belt many farmers are often so situated that they have no other grain feed at hand. If corn must make up the greater part of the ration of the brood sow, the injurious effects may be counteracted in a measure by compelling the sows to exercise. Various schemes may be necessary to bring about this result, such as having the house and feeding floor or the feeding floor and watering place at opposite ends of the hog lot; so that a good walk is a necessity several times each day. If the lot is located on a hillside, the walk is made a climb. Some men scatter grain among straw and corn fodder with this idea

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<sup>a</sup> Bulletin 53, Missouri Experiment Station.

of exercise in mind, and others resort to the whip and drive the sows gently for a mile or two each day.

During the winter more care will be needed to keep the sow in good health on account of the absence of pasture. Not only does the hog's system crave green feed, but more or less bulk is demanded. This is especially needed when a considerable amount of confinement is necessary. To offset the lack of green feed nothing surpasses roots. These may be sliced or pulped and mixed with the grain or may be given whole, as a noon feed. Some care must be used in feeding roots, as they are laxative in effect, and if fed in excessive amounts may bring about profuse action of the bowels. Some Eastern farmers recommend the use of silage. If neither is available, clover or alfalfa hay, sheaf oats, or corn fodder may supply the bulky requirement of the ration with good results. Charcoal, ashes, and salt should be accessible at all times. These act as a vermifuge and preventive of disease and meet the hog's craving for mineral matter in the feed. The Bureau of Animal Industry formula is found on

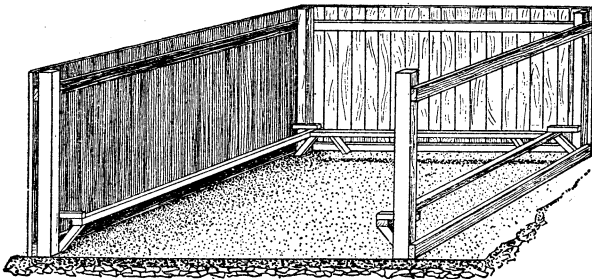


FIG. 19.—Farrowing pen with fenders.

another page in this bulletin. (See p. 42.) The constant use of such a preparation with a varied and not too carbonaceous ration and care in removing the afterbirth will, in large measure, prevent sows from eating their pigs at farrowing time. During the entire period care should be taken to keep the system well toned. The sow should become accustomed to being handled, and should look upon her attendant as a friend.

All the brood sows may run together up to within two weeks of farrowing time; then it is well to separate them, placing each sow by herself in a yard with a small house, such as has been described, which should be dry, airy, and clean. A great deal of exercise will not now be necessary. The feed should be reduced somewhat, and if there is any tendency to constipation a slight change of feed may be necessary. If individual houses are not available, sows can not be separated until near farrowing time.

The farrowing pen should be provided with fenders around at least three sides about 6 or 8 inches from the floor and 6 or 8 inches from the wall. These should be strong enough to support the weight of the sow should she lie on them. They will, to a great extent, protect the pigs from being lain upon during the first few days of their lives. This will go far to prevent a very fruitful cause of loss among young pigs. The little fellows will soon learn to creep under these fenders when the sow lies down. Figure 19 shows a farrowing pen with fenders made of 2 by 4 scantling fastened around the walls.

Many breeders now use a specially arranged farrowing pen for sows, the object being to allow the sow room enough to farrow with reasonable comfort, but not enough to turn around. The safety of the pigs under such circumstances is said to be much greater than when the sow is given all the space she cares to take. Provision is made for the safety of the pigs by raising the walls of the pen 6 or 8 inches from the floor. Such a pen may be readily arranged by placing the sow at one end of her pen and nailing boards across so that she can not turn, leaving space for the pigs to slip under the barrier. A number of patented farrowing pens are on the market.

**Farrowing time.**—Sows vary little in the period of gestation. This period is about one hundred and twelve days from the date of breeding. This date should be known, to avoid mistakes that may result in loss of pigs. As the time for farrowing approaches the sow should be watched carefully, in order that assistance may be given, if necessary. If she has already farrowed a litter, and has been properly fed and cared for during pregnancy, little difficulty may be expected. With young sows, particularly those bred at an immature age, there is a considerable element of risk at this time not only to the pigs, but to the sow herself.

The bedding of a sow at farrowing time should be sufficient only for cleanliness and dryness. If furnished in large amount, the pigs will burrow into it and get lost or be crushed. The best bedding is rye straw and wheat straw, and if the straw is cut it makes an almost ideal bed. Chaff is excellent if it can be obtained. Oat straw is not so valuable.

The management of sows during farrowing will depend largely on the animal and on the weather conditions. Assistance should be at hand if needed, but the sow should not be helped if she is getting along nicely alone. Many pigs are lost annually by lack of attention during farrowing; but, on the other hand, there is no doubt that in many cases overanxiety and too much attention may do more harm than good and often result seriously. The assistance that is imperative at this time is to help in cases of difficult labor and to protect pigs from chilling in cold weather. The temperament of the sow should

be considered; some are plainly annoyed by the presence of an attendant and show it in their nervous actions; others may be positively ill natured and resent interference. Such sows are better left alone during farrowing, and should be bred to farrow when warm weather may be expected, so that the chances are as much in favor of the pigs as possible. If the sow's nervousness or ill nature leads her to eat her pigs, the best remedy is to put her in the pork barrel at the earliest opportunity.

When farrowing occurs during warm weather, a minimum amount of attention will be needed. The pigs are less likely to become chilled at this season and will generally find their way to the teats unaided. Proper preliminary feeding of the sow and good quarters will make the chance of trouble small. On the other hand, if a sow farrows during extremely cold weather the pigs will be in danger of being chilled unless the house is heated. To remedy this some breeders throw a blanket over the sow until she is through. Others place a few hot bricks or a hot soapstone in the bottom of a basket or barrel, covering them with straw, and put a cloth over the top to prevent too rapid radiation; and, unless the sow objects too seriously, the pigs are placed in this receptacle as fast as they arrive. They will not suffer if they do not suck for a few minutes, and they will be dry and warm when placed to the teats. This treatment will be necessary even in warm weather with sows that are nervous and move about during farrowing. When farrowing is over the pigs should all be placed to the teats, care being taken that each one gets his share. When the afterbirth is passed it should be removed at once and burned or buried. There is good reason to believe that the eating of the afterbirth is often the beginning of the habit of eating the pigs that is so troublesome with some sows.

In very cold weather it may be necessary for a few days to remove the pigs to a warm place after they have sucked, to prevent chilling. As newborn pigs suck as often as every two hours during the day, this entails considerable inconvenience; but it is time well spent and may mean the difference between profit and loss to the breeder. The pigs are soon able to fight their battles with the cold unaided by any but their own warmth and that of the dam.

For the first twenty-four hours the sow should, as a rule, have no feed, and will need none. If, however, she shows signs of hunger, a thin slop of bran and shorts or a thin oatmeal gruel may be given. Tepid water should be given to drink as the sow wants it. Never give cold water.

The feeding for the first three or four days should be light and carefully given, and the time consumed in getting the sow on full feed should be from a week to ten days, depending on the size and

thrift of the litter. The first feed should be very light, and in the form of a thin, warm slop, such as is mentioned in the preceding paragraph, working gradually to full feed. The pen should be cleaned daily if the sow is confined to it.

#### THE SOW AS A MOTHER.

No time should be lost after farrowing in getting the sow into the open air. Of course, if the pigs were farrowed during the winter months care will be needed, and it may be necessary to let the pigs reach the age of two weeks before turning them out. They can, however, get considerable exercise in the piggery or in the lot with the sow, and there is often a lot adjoining a barn that is sunny and sheltered from cold winds where the new family may be turned out for exercise. Avoid particularly allowing the pigs to run out during a cold rain. They are especially tender during the first weeks.

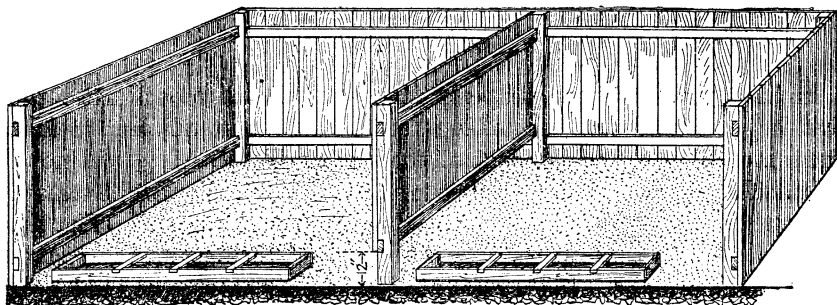


FIG. 20.—Double pen for feeding sucking pigs; partition raised to permit pigs to run to their feed without interference from the sow.

The appetite for something besides the dam's milk may begin to assert itself by the time the pigs reach three weeks of age. This time will vary, of course, some pigs being more precocious than others. They will be noticed nibbling at grass, rooting a little, and even investigating the sow's feed. A pen should be arranged adjoining that of the dam and separated from it by a partition, with sufficient room at the bottom to allow the pigs to run under. Figure 20 shows a pen arranged with a raised partition between it and the dam's pen. In this inclosure put a low, shallow trough and place in it a little skim milk or a thin gruel similar to that recommended for the sow the first day after farrowing. This gruel may be made with any concentrate that is free from woody matter. If ground barley or oats is fed the meal should be first sifted to remove the hulls. There is a great variety of feeding stuffs that can be used. The main point to be observed is that the pig's stomach is very easily deranged at this age and feeds must be given that will digest readily. The trough in



which the pigs are fed should be kept clean. No stale feed should be allowed to remain in it from one feed to the next.

As the pigs learn to eat the feed may be increased. Skim milk should be used liberally, using rather large quantities at first—from 6 to 12 pounds of milk to each pound of grain. During this period comparatively little corn should be fed, as a rule. More growth can be obtained with a narrow ration, and the corn should be withheld until the fattening period comes. The pigs should be kept growing constantly, and the best results will come with feeding a little under their capacity rather than all they can consume. To counteract the tendency to become too fat they should have plenty of exercise.

Scours and thumps often cause very serious losses among young pigs. The former is caused usually by overfeeding, by feeding badly spoiled feed, by an abrupt change of feed, or by a change in the feed of the dam that affects her milk. Thumps is generally caused by overfeeding and lack of exercise.

#### WEANING.

If the pigs have been properly managed for the month after they first begin to eat, and are taking feed in amounts sufficient to make them more or less independent of the sow's milk, weaning will not be a difficult process, and will be brought about so that it will be scarcely perceptible, so far as the effects on the pigs are concerned. The time to wean will depend on the way the pigs are eating and the convenience of the breeder. If they are not thoroughly accustomed to a grain and skim-milk ration the time must be delayed, and if there is no occasion for breeding the sow no harm is done by allowing the pigs to run with her to the age of twelve weeks or older.

Breeders differ widely as to the age of weaning. The majority wean at six to ten weeks, with a considerable number at twelve weeks; some wean later than twelve weeks and a few earlier than six weeks. The breeders who wean at the early periods usually are situated where dairy by-products are plentiful, and they usually raise two litters each year, making the demands of the pigs on the sow as brief and light as possible. Breeders in the corn belt wean at the more mature ages, rarely weaning as young as six weeks, and often allowing the pigs to reach the age of sixteen weeks before the sow is taken away. A considerable number make no attempt to wean as the word is generally used; that is, there is no enforced separation of the sow from her pigs; the pigs run with the sow until her instinct tells her that they are old enough to shift for themselves.

The method of weaning will depend somewhat on circumstances. If the pigs are so little dependent on the sow's milk that she is gaining rapidly in flesh and lessening in milk flow the weaning may be

abrupt, the sow being taken away out of hearing. If she is still milking considerably she may be returned to the pigs once a day for two or three days, or the pigs may be taken away in detachments, beginning with two or three of the largest and strongest, then the next strongest, leaving the weakest ones of the litter to complete the drying off.

Whether the weaning is brought about directly or gradually, it should in all cases be complete and decisive. The pigs should be placed apart from the sows in quarters secure enough to prevent communication. By no means should pigs be allowed to follow a sow until she is almost worn out. The pigs are no better and the sow infinitely worse than if weaning had been brought about properly.

#### THE PIGS AFTER WEANING.

Attention will now be given to the pigs that have been weaned. Up to this time all are on the same feed and under the same management. From now on, however, those that are to be retained as breeding animals should be continued on a growing ration—that is, one which is somewhat narrow and will develop bone and muscle to the largest extent. Those that are to be fattened for market should be fed more liberally and their feed made more carbonaceous.

**The breeding stock.**—The foundation on which to build up a successful breeding animal is ample range, affording an abundance of exercise, and a rather narrow ration. Growth should be continuous and feed plentiful. The pigs should not be given so large a range and so little feed that they will develop nothing but bone; neither should they have so much to eat that they will become indolent and refuse to take the exercise required to develop necessary bone and muscle. Exercise will strengthen the sinews and develop strong muscles, as well as firm joints and strong legs, while a well-filled stomach will nourish these; and from this management we may expect a sow that will be strong, thrifty, and a good breeder, and a boar that will do good work in the herd without breaking down in any respect before he should.

Gilts should not be served before the age of eight months, bringing the first litter at twelve months. This gives sufficient time for the development of the reproductive organs.

**Fattening for market.**—As soon as it is determined what pigs are to be fed for market their fattening should be started without delay. Experiments have repeatedly proved that young animals always fatten more economically than old ones, and therefore any delay in finishing is accompanied with a loss. In rare instances it may pay to keep a pig over winter as a “store” hog, but generally he loses the flesh he accumulated while suckling his dam, and this can not be replaced except at increased expense. Corn will now come into the

ration, and should be supplemented by all the variety of feed at the feeder's command, to keep the appetite keen and the digestive system in the best condition. This variety should consist of mill feeds, dairy by-products, and succulent feeds, and, according to some authorities, pasture. If skim milk, whey, and buttermilk are at command they can be combined to very good advantage with the ration, commencing with a proportion of about 2 pounds of milk to 1 of grain at weaning time, and reducing the quantity of milk until the pigs are finished on grain alone. A pig gives best returns from dairy by-products while young. The fattening pigs should gain from 1 pound to  $1\frac{1}{2}$  pounds daily, and should weigh between 250 and 300 pounds at 9 or 10 months of age. Gains made after this weight are nearly twice as expensive as those made when weighing from 50 to 100 pounds, and a well-bred pig having good quality and conformation finished at a weight of about 250 pounds will very nearly fill the market requirements and bring a satisfactory price.

**Selection of breeding stock.**—The pigs which are to be used for breeding purposes should be selected during the time when the pigs are with the sow. If the breeder is raising hogs for market he will select only sows, castrating all boars. No boar should be used or sold that is not eligible to registry. If the breeder is raising pure-bred stock the inferior boars will be culled out and castrated, the others being kept for the breeding market.

The selections should be made as early as possible, depending on the skill of the breeder. That noted feeder, the late Mr. William Watson, used to select his show lambs and calves not later than three days of age. He said an animal had at that age all the development of heart and rib he would ever get, and his results in the show ring bore out the accuracy of his judgment. However, all are not endowed with the keen insight into animal form that Watson possessed. A selection for a breeding animal should not be made unless there are good and sufficient reasons for it, and unless the breeder is quite sure he is right in making the selection. The sows selected should be from large litters and from dams that are good milkers, and of quiet, motherly dispositions.

**Castrating and spaying.**—The boar pigs should be castrated during cool weather, as soon as the testicles descend into the scrotum. An early date is always preferable to a late one, for the development of sex characteristics is of no value to an animal that is intended for meat.

The practice of spaying sows is not very general. It is much more difficult than castration. It often happens that sows may become pregnant before spaying and bear a good litter of pigs after that operation.

### MANAGEMENT OF THE DRY SOWS.

After the pigs are weaned the dry sows should be placed in a pasture by themselves and given very little grain. Those that show themselves to be prolific and good mothers should be retained as breeders; those having a deficient breeding record or are otherwise unsatisfactory in any way should be fattened and sold as soon as possible. It does not pay to keep over a year a sow that can not raise a large litter, unless she is purebred and a very exceptional individual.

If a second litter is wanted during a year the sows should be put to the boar during the first heat after weaning. Many breeders do not like to pass periods of heat for fear that the sows may become "shy," and there is little reason why a sow should not have two litters a year. In any case, the sows should be carried on comparatively light

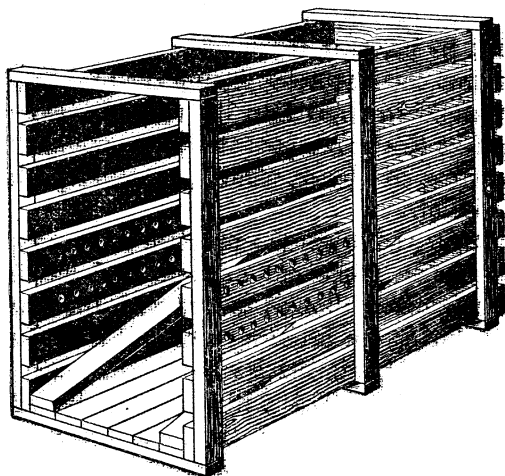


FIG. 21.—Breeding crate.

feed until time to breed again, gaining a little in weight; and their treatment after breeding should be as already detailed for pregnant sows.

The use of a breeding crate (fig. 21) is growing in popularity. When a small sow is to be bred to a large, heavy boar it is almost a necessity; its use prevents injury to the sow. Some sows, although in heat, will not take the boar readily, and the use of a crate in these cases insures a successful service. Many breeders use a crate for all their sows. Such an appliance may be made by any carpenter. All that is necessary is a stout frame, made of 2 by 4 inch scantlings, closed in front but open behind, a bar to slip behind the sow just above the hocks, and a 2 by 4 inch strip attached at the forward end of the

crate on either side, about the position of the sow's head and extending to the rear of the crate, where it is fastened to the bottom of the crate. The boar's fore feet will rest on these strips.

#### MANAGEMENT OF THE BOAR.

When the boar arrives at the farm he should be dipped, as a matter of ordinary precaution against the introduction of vermin. As an additional precaution, a quarantine pen should be ready for him, especially if epidemics are prevalent. In short, he should be treated in much the same manner as has been prescribed for the sows. His feed before change of owners should be known, and either adhered to or changed gradually to suit the new conditions. If he has come from a long distance it will be well to feed lightly until he is well acclimated.

His permanent quarters should be a clean, dry, warm, well-lighted, and well-ventilated pen, 10 or 12 feet square, with a yard adjoining where sows may be brought for service. This yard should be large enough to give him some exercise during the breeding season, when it may be inconvenient to allow him the run of a pasture. Adjoining the yard should be the boar's pasture, from one-half acre to an acre in extent, consisting of clover, alfalfa, or good pasture grasses that thrive in the locality.

Breeders generally advocate the practice of keeping a boar to himself during the entire year—out of sight and hearing of the sows. However, a boar is often allowed to run with the sows after they are safe in pig; but during the breeding season it is by far the best policy to keep him by himself, admitting a sow to his yard for mating, and allowing but one service. This will be productive of the best results in many ways. The energies of the male are not overtaxed. He may thus serve a much larger number of sows, and the litters will generally be larger and the pigs stronger. In the case of a sow that is a somewhat shy breeder and a valuable animal she may be allowed to remain with a boar during the greater part of her heat, but such instances are exceptional. Another advantage of the single-service system is that a man always has an accurate knowledge of his breeding operations and knows when to expect farrowing time.

The feed of the boar when not in service may be of a succulent nature—mainly pasture and cut green forage during the summer months and roots in winter. A boar can hardly be sustained on this alone, and some grain should be allowed to keep him in condition. This should be nitrogenous in character, consisting of mill feeds—such as shorts, middlings, and bran—some oil meal, and the leguminous grains, with a little corn. As the breeding season approaches the feed should be increased, so that the boar will be in good condi-

tion. While not in service ample exercise should always be insisted upon, even if it must be urged by the whip. Exercise is productive of well-developed muscles and general thrift; with these two conditions activity and soundness of reproductive organs will usually follow. During the breeding season it will not be possible for the boar to get the same amount of exercise, and accordingly care must be taken that his energies are not wasted by unnecessary service. Careful feeding will do much to counteract this disadvantage. It must always be remembered that the drains on a boar during service are severe, especially if 50 or 60 sows are served. This will require ample feed, with as much exercise as possible, and, with care in his treatment, the results should be satisfactory. A fully matured boar should not serve more than 2 sows daily, preferably one in the morning and one in the afternoon, and can serve 50 or 60 in a season without difficulty.

Coburn<sup>a</sup> advises that where farmers own but 12 or 15 sows each, three or four breeders might purchase a boar and use him in common, thus saving materially in expense. Cownie<sup>b</sup> states that he has found it well to have at least two boars in the herd, even though the herd be small in numbers.

### SANITATION IN THE HOG LOT.

The greatest drawback to the hog industry which breeders in this country have to contend against is found in the losses which may be experienced through outbreaks of hog cholera or swine plague, through the contraction of tuberculosis, or through the infestation of the animals, especially young pigs, by parasites. Were it not for the fecundity of these animals their profitable production in the presence of these serious diseases would be out of the question.

In the following remarks on sanitation no attempt is made to go into the details of the diseases affecting hogs or their treatment. The object is merely to call attention to the simple measures which may be used by any farmer to avoid, to a large extent, the decimation of his herd by epidemics. Cleanliness and rational methods of management are relied upon by thousands of farmers to keep their herds in health and vigor. They are the marks of the good farmer and successful hog breeder.

Hog cholera and swine plague, both epizootic, bacterial diseases characterized by fever and great fatality, are so very similar that the breeder may regard them as identical so far as his practical management of the herd is concerned. Positive differentiation between

<sup>a</sup> Swine Husbandry, pp. 93, 94.

<sup>b</sup> Kansas State Board of Agriculture, Thirteenth Biennial Report, p. 693.

the two diseases can only be made by the most careful bacteriological tests, and by employing the assistance offered by a fully equipped laboratory. However, remedies or preventive methods which are found beneficial with one of these diseases will prove equally efficacious with the other.

There are a few fundamental facts which the breeder must remember if he is to avoid losses by reason of the presence of hog cholera or swine plague in the herd. The first is that they are specific germ diseases disseminated by bacteria, and the contagion can not be spread from one animal to another or from one herd to another except through the agency of these minute organisms. They may be carried in a multitude of ways—by the hogs themselves, on the clothing of persons, on vehicles, in feed, by birds, dogs, or other animals, or by streams. The breeding or feed of a hog can not cause either disease, although bad methods may so weaken the constitution and vitality that the animal becomes more susceptible to them than would otherwise be the case. Since these diseases can only arise from the presence of their specific causative agents, it can readily be seen that dentition and the presence of supernumerary teeth or black tusks can not, as has been suggested by many, play any part in their development. A second fact to be borne in mind is that diseases caused by bacteria may be best prevented or controlled by thorough disinfection and scrupulous cleanliness.

Tuberculosis is rapidly increasing among the hogs of this country, and every owner of swine should be on his guard against the introduction of this serious malady upon his premises. Unlike hog cholera, this disease is insidious in its attack and slow in its development, so that it may be present for months in a herd without exciting the least suspicion of the owner, and will be revealed to him only at the time of slaughter. Until recent years this disease has been looked upon as of uncommon occurrence and only of importance from a meat-inspection standpoint; but to-day it must be recognized as a serious menace to the owner of hogs, and especially to the one who allows his hogs to run with his cattle that have not been proved to be free of tuberculosis, or who feeds them upon nonsterilized dairy products as part of their ration. As tuberculosis of hogs is chiefly an ingested disease, the importance of this statement is obvious.

Tuberculosis of hogs is closely associated with the same disease in cattle, the reason being apparent when one considers the close relations of these two species of animals upon nearly every farm. Tuberculous cattle may scatter great numbers of tubercle bacilli with their excrement; cows that are tuberculous may produce milk that is contaminated with tuberculous products, or carcasses of cattle that have died from tuberculosis may be fed to the hogs; and any of

these conditions make the infection with tuberculosis of the hogs concerned a very easy matter.

The feeding of hogs upon creamery refuse is also a very frequent source of infection. In this way the milk of a single cow with a tuberculous udder, if sent to a public creamery, may spread the disease to a number of hogs, and may also infect many farms that have never been contaminated with tuberculosis before.

An equally dangerous source of infection is likewise observed in the methods which obtain among some of the small country slaughter-houses. It is not unusual for these houses to get rid of their blood, intestines, viscera, and other inedible parts by feeding them to hogs, a herd of which is usually kept on the premises. This custom is pregnant with danger and serves to perpetuate the infectious principle of various contagious and parasitic diseases, and particularly an ingested disease like tuberculosis.

Hogs are also susceptible to tubercular infection from tuberculous persons and from tuberculous poultry, but these sources are undoubtedly of far less moment to the hog owner than those existing in a herd of tuberculous cattle.

Intestinal worms, lung worms, and skin parasites also levy a burdensome tax upon the profits of hog raising. Absolute cleanliness will be found valuable in preventing and controlling these parasitic troubles, as well as the more serious diseases—hog cholera and tuberculosis.

#### PREVENTION OF DISEASE.

In dealing with the diseases of hogs, preventive measures must be most relied upon. The animals must be given dry and well-ventilated quarters, which must be kept clean. Contrary to common belief, hogs have some habits which raise them above other domestic animals from the standpoint of cleanliness. For example, unless compelled to do so, a hog will not sleep in its own filth. If part of the floor of the pen is raised and kept well bedded with straw, while the rest is not, all excrement will be left on the unbedded portion of the floor, and the bed itself will be always clean.

In addition to cleanliness, close attention should be given to the feed which is supplied, that nothing may be fed which will convey the germs of disease, especially tuberculosis, to the herd. If the hogs are fed milk in any form obtained from cows kept upon the same farm, the cows should be subjected to the tuberculin test, as by this means all tuberculous milk may be kept from the hogs. If they run with the cattle of the farm a tuberculin test of all the cattle is none the less desirable. Animals dead from any disease should not be fed to the hogs until the meat has been made safe by cooking. Skim milk



or refuse from a public creamery should not be fed to hogs until it has been thoroughly sterilized.

Feeding and drinking places should be clean and the water supply pure. Unless the origin is known to be uncontaminated and there has been no possibility of infection during its course, hogs should not be allowed access to any stream. Wallows should be drained out or kept filled up as much as possible. At least once a month the quarters should be disinfected with air-slaked lime or a 5 per cent solution of crude carbolic acid. These precautions will be found valuable aids in the destruction of the various animal parasites, as well as a protection from some more serious troubles.

**Breeding and feeding.**—While inbreeding is the surest and quickest means to fix type, it should be resorted to with the greatest care. The value of the system is that it enables the breeder to intensify desirable characteristics in a herd and makes improvement possible in a shorter time than where selection alone is used. It stands to reason that if desirable characteristics may be intensified, the same will be true of undesirable ones. Much of the disaster which seems to have followed inbreeding has probably been due to the fact that this point was overlooked or given only slight importance, and thus loss of vitality and constitution and susceptibility to disease have followed. Therefore if the young breeder contemplates inbreeding, he should avoid matings which would tend to unite similar defects. Not only should care be taken to prevent this in the animals mated, but there should be no chance of bad effects due to the inheritance of undesirable characteristics from parents and other ancestors. Some of the greatest work ever done in hog breeding has been based on these principles.

The straight corn diet which many hogs receive from one year's end to the other also lessens vitality, and the researches of the Wisconsin Experiment Station have shown that this is probably brought about by retarding the development of the vital organs. A minimum of inbreeding and a varied diet, including, especially for breeding stock, ample range, will therefore better enable the herd to resist the attacks of disease.

**Isolated houses.**—The advantage of a number of small portable houses, each accommodating a few hogs, rather than one large pig-gery for the entire herd, has been referred to previously. In districts where cholera is prevalent these are undoubtedly the best shelters. They make it more difficult to carry contagion to all animals in the herd, and the destruction of one of them in case of an outbreak does not entail a great expense. An added advantage is that they may be moved from place to place as needed. While more work is necessary in feeding, the convenience and safety from their use more than offset this disadvantage.

**Quarantine.**—Whenever any animals are brought to the farm, or when animals are brought home from shows or from neighboring farms, they should be kept apart from the rest of the herd for at least three weeks. If they have been exposed to hog cholera or swine plague the diseases will be manifested within this time, and the sick animals can be treated or killed and disposed of at once.

If cholera breaks out in the neighborhood the farmer should maintain a strict quarantine against the infected herds. He should refrain from visits to farms where they are located, and should insist on requiring that his neighbors stay out of his hog lots. Visiting of all kinds at this time should be carefully restricted. Dogs, cats, crows, and buzzards are very active carriers of infection from farm to farm, and should be guarded against as far as possible.

#### TREATMENT OF DISEASES.

As soon as sickness appears in the herd the unaffected hogs should at once be removed to clean, disinfected quarters, preferably without much range, for by running over pastures they may come in contact with contagion. Their feed should be carefully regulated, and, if they have previously been on pasture, should include some green feed, roots, or an abundance of skim milk.

The quarters in which the sickness first appeared should be thoroughly cleaned, all bedding and rubbish burned, and loose boards and old partitions torn out and burned. If the pen is old, knock it to pieces and burn it. Disinfect pens and sleeping places, using air-slaked lime on the floors and the carbolic-acid solution on the walls and ceilings. Whitewash everything. If a hog dies from any cause, the carcass should never be exposed where it may be devoured by the other hogs or by passing birds or beasts, but should be burned at once or buried deeply and the pens thoroughly disinfected immediately. If possible, do not move the carcass from the place where it falls; but if this can not be done the ground over which it is dragged should be disinfected. Hog-cholera bacilli can live in the ground for at least three months. Care must be taken to maintain an absolute quarantine between the sick and well hogs. The same attendant should not care for both lots unless he disinfects himself thoroughly after each visit to the infected hogs. Dogs should be confined until the disease is stamped out.

Treatment of hogs suffering from cholera or swine plague is not always satisfactory. The disease runs its course so rapidly that curative measures are more or less ineffectual, and prevention of an outbreak should be relied upon rather than the cure of sick animals. Salmon <sup>a</sup> states that the following formula has been successful in less

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<sup>a</sup> Farmers' Bulletin 24, U. S. Department of Agriculture.

virulent outbreaks when properly administered as soon as signs of sickness are shown:

	Pounds.
Wood charcoal -----	1
Sulphur -----	1
Sodium chlorid -----	2
Sodium bicarbonate -----	2
Sodium hyposulphite -----	2
Sodium sulphate -----	1
Antimony sulphid (black antimony) -----	1

These ingredients should be completely pulverized and thoroughly mixed. In case there is profuse diarrhea the sulphate of sodium may be omitted.

A large tablespoonful once a day for each 200 pounds of live weight of hogs to be treated is a dose. The medicine should be thoroughly mixed with the feed, which should be soft, made of bran and middlings, corn meal and middlings, corn meal and ground and sifted oats, or crushed wheat, mixed with hot water. If the hogs are too sick to come to the feed, they should be drenched by pulling the cheek away from the teeth and pouring the medicine in slowly. Care should be exercised, as hogs are easily suffocated by drenching. Do not turn a hog on its back to drench it.

#### PREVENTION AND DESTRUCTION OF VERMIN.

Hogs often suffer very much from vermin. Lice are introduced from neighboring herds, and the losses in feeding are often severe, especially among young pigs, when death is sometimes a secondary if not an immediate result. When very numerous, lice are a very serious drain on vitality, fattening is prevented, and in case of exposure to disease the lousy hogs are much more liable to contract and succumb to it.

Newly purchased hogs should be carefully examined for vermin, and they should not be turned out with the herd until they are known to be free from these pests.

When the herd is found to be badly infested with lice all bedding should be burned and loose floors and partitions torn out. Old boards and rubbish should be burned. The quarters should then be thoroughly disinfected by spraying with one of the solutions mentioned. After disinfection, as in the case of a disease outbreak, everything about the place, inside and out, should be thoroughly whitewashed.

Vermin are most common around the ears, inside the legs, and in the folds of the skin on the jowl, sides, and flanks. In light and isolated cases they may be destroyed by washing the hogs with an emulsion of crude petroleum or of kerosene, or with a stock dip properly diluted, applied by means of a broom. In severe cases, however, especially where the whole herd is affected, thorough spraying or dipping should be resorted to. In this case a dipping tank will be a great convenience.

Figure 22 shows the ground plan and side elevation of the pig-

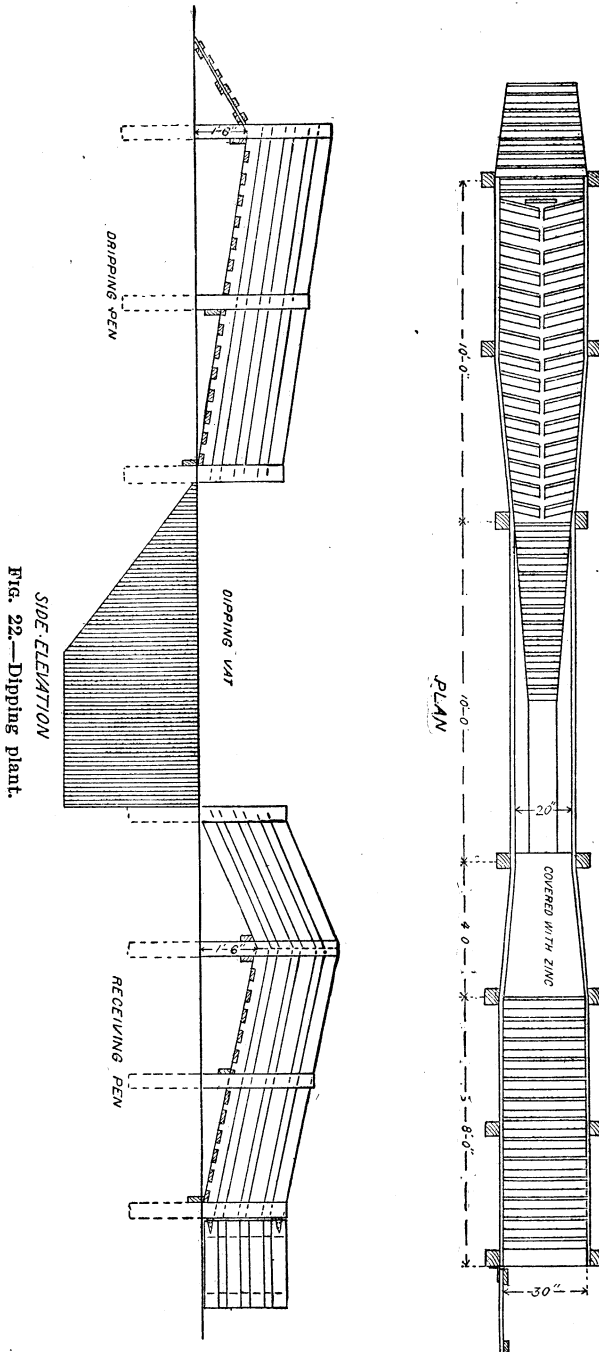


Fig. 22.—Dipping plant.

dipping plant suggested by the Nebraska Experiment Station.<sup>a</sup> The

<sup>a</sup> Bulletin 74.

details of construction may be understood from the drawings. The approach from the yard to the slide is cleated and elevated, at the inner end, 1 foot 6 inches above the ground. The slide is covered with zinc or galvanized iron, and with this pitch is very slippery when wet. The zinc which covers the slide is lipped over the edge of the tank to prevent waste of the dip. The tank is placed in the ground with its edges even with the surface. A galvanized tank is suggested; it can be easily made by a tinner. The size of the tank will depend on the number of hogs to be dipped. The one in the drawing is 4 feet deep, 10 feet long at the top, 5 feet long at the bottom, 20 inches wide at the top, and 8 inches wide at the bottom. The sloping surface of the tank should be cleated or fluted to enable the hogs to get out easily. The dripping pen is raised 1 foot 6 inches at the outer end and is cleated. The cleats are laid at an angle with the sides of the pen and arranged in pairs, with a space between them so that the dip may drain back into the tank. Provision must be made for the displacement of fluid by means of tongued-and-grooved boards fastened to the sides of the vat.

The dipping vat may be used for the application of any of the various coal-tar dips on the market. The directions for mixing and using these dips as given by the manufacturers should be carefully followed. Dipping in a 20 per cent emulsion of crude petroleum is very effective not only against lice, but also against mange, with which hogs are occasionally affected. In mixing the dip a stock emulsion is first made in the following proportions:

Crude petroleum -----	gallons..	4
Water -----	do.....	1
Hard soap (ordinary laundry soap)-----	pound..	1

The soap is cut into shavings and dissolved in the water with the aid of heat. The crude petroleum is then added and the mixture vigorously agitated by shaking, churning, or pumping through a spray pump. When thoroughly mixed sufficient water is added to make 20 gallons of diluted dip. For larger quantities of dip proportionately greater amounts of the different ingredients are of course taken. The quantity of diluted dip necessary to fill a vat of the dimensions given above to a depth of 40 inches is 200 gallons. One hundred gallons will fill it to a depth of 26½ inches. Soft water is necessary for a perfect emulsion.

Dips mixed in the same proportions as for use in a vat may be applied by means of a broom or by spraying with a spray pump. Kerosene emulsion, which can not well be used in a vat on account of the rapidity with which the oil and water separate when the emulsion is diluted, may be used very satisfactorily with a spray pump.

A stock emulsion is made in the following proportions:

Kerosene .....	gallons..	2
Water .....	do.....	1
Hard soap.....	pound..	$\frac{1}{2}$

Boil the water and soap until the latter is dissolved, remove from the fire, then add the kerosene and agitate vigorously until a smooth white mixture or emulsion is formed. When diluted with sufficient warm water to make 20 gallons the emulsion contains 10 per cent of kerosene and is ready for use. Ten per cent kerosene emulsion is as a rule fully effective, but if desired 20 per cent emulsion may be used without danger of injury to the hogs. In the latter case sufficient water is added to the stock emulsion to make 10 gallons of diluted solution.

A wallowing tank may be utilized in the treatment of hogs for lice. The tank should be about 14 inches deep, and should be under cover of a shed. It is partially filled with water and the surface of the water is covered with oil by pouring in a sufficient quantity of crude petroleum. When necessary the oil and water are replenished, and the tank of course requires occasional cleaning. To prevent the formation of mudholes the ground surrounding the tank should be surfaced with rock or concrete. Lewis<sup>a</sup> makes the following statement of his experience with the wallowing tank:

The hogs in wallowing would get sufficient oil on them to destroy the lice. By keeping this arrangement in operation the hogs were kept free from lice and without any unnecessary worrying or handling.

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<sup>a</sup> Bulletin 72, Oklahoma Experiment Station.



## FARMERS' BULLETINS.

The following is a list, by number, of the Farmers' Bulletins available for distribution. The bulletins entitled "Experiment Station Work" give in brief the results of experiments performed by the State experiment stations. Titles of other bulletins are self-explanatory. Bulletins in this list will be sent free to any address in the United States on application to a Senator, Representative, or Delegate in Congress, or to the Secretary of Agriculture, Washington, D. C. Numbers omitted have been discontinued, being superseded by later bulletins.

22. The Feeding of Farm Animals. Pp. 40.
24. Hog Cholera and Swine Plague. Pp. 16.
27. Flax for Seed and Fiber. Pp. 16.
28. Weeds and How to Kill Them. Pp. 30.
29. Souring and Other Changes in Milk. Pp. 22.
30. Grape Diseases on the Pacific Coast. Pp. 15.
32. Silos and Silage. Pp. 30.
33. Peach Growing for Market. Pp. 24.
34. Meats: Composition and Cooking. Pp. 31.
35. Potato Culture. Pp. 24.
36. Cotton Seed and Its Products. Pp. 16.
42. Facts About Milk. Pp. 32.
44. Commercial Fertilizers. Pp. 38.
47. Insects Affecting the Cotton Plant. Pp. 32.
48. The Manuring of Cotton. Pp. 16.
51. Standard Varieties of Chickens. Pp. 48.
52. The Sugar Beet. Pp. 48.
54. Some Common Birds. Pp. 48.
55. The Dairy Herd. Pp. 30.
56. Experiment Station Work—I. Pp. 30.
58. The Soy Bean as a Forage Crop. Pp. 24.
59. Bee Keeping. Pp. 48.
60. Methods of Curing Tobacco. Pp. 24.
61. Asparagus Culture. Pp. 40.
62. Marketing Farm Produce. Pp. 31.
63. Care of Milk on the Farm. Pp. 40.
64. Ducks and Geese. Pp. 55.
65. Experiment Station Work—II. Pp. 32.
66. Meadows and Pastures. Pp. 30.
69. Experiment Station Work—III. Pp. 32.
71. Essentials in Beef Production. Pp. 24.
72. Cattle Ranges of the Southwest. Pp. 32.
73. Experiment Station Work—IV. Pp. 32.
74. Milk as Food. Pp. 39.
77. The Liming of Soils. Pp. 24.
78. Experiment Station Work—V. Pp. 32.
79. Experiment Station Work—VI. Pp. 27.
80. The Peach Twig-borer. Pp. 16.
81. Corn Culture in the South. Pp. 24.
82. The Culture of Tobacco. Pp. 22.
83. Tobacco Soils. Pp. 23.
84. Experiment Station Work—VII. Pp. 32.
85. Fish as Food. Pp. 32.
86. Thirty Poisonous Plants. Pp. 32.
87. Experiment Station Work—VIII. Pp. 32.
88. Alkali Lands. Pp. 23.
91. Potato Diseases and Treatment. Pp. 15.
92. Experiment Station Work—IX. Pp. 30.
93. Sugar as Food. Pp. 31.
95. Good Roads for Farmers. Pp. 46.
97. Experiment Station Work—X. Pp. 32.
98. Suggestions to Southern Farmers. Pp. 48.
99. Insect Enemies of Shade Trees. Pp. 30.
100. Hog Raising in the South. Pp. 40.
101. Millets. Pp. 30.
102. Southern Forage Plants. Pp. 48.
103. Experiment Station Work—XI. Pp. 30.
104. Notes on Frost. Pp. 24.
105. Experiment Station Work—XII. Pp. 32.
106. Breeds of Dairy Cattle. Pp. 48.
107. Experiment Station Work—XIII. Pp. 32.
108. Saltbushes. Pp. 20.
110. Rice Culture in the United States. Pp. 28.
111. Farmer's Interest in Good Seed. Pp. 24.
112. Bread and Bread Making. Pp. 40.
113. The Apple and How to Grow It. Pp. 24.
114. Experiment Station Work—XIV. Pp. 28.
116. Irrigation in Fruit Growing. Pp. 48.
118. Grape Growing in the South. Pp. 32.
119. Experiment Station Work—XV. Pp. 30.
120. Insects Affecting Tobacco. Pp. 32.
121. Beans, Peas, and other Legumes as Food. Pp. 38.
122. Experiment Station Work—XVI. Pp. 32.
124. Experiment Station Work—XVII. Pp. 32.
125. Protection of Food Products from Injurious Temperatures. Pp. 24.
126. Practical Suggestions for Farm Buildings. Pp. 48.
127. Important Insecticides. Pp. 46.
128. Eggs and Their Uses as Food. Pp. 40.
129. Sweet Potatoes. Pp. 40.
131. Household Tests for Detection of Oleomargarine and Renovated Butter. Pp. 10.
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